

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of: John Davis Holder Art Unit: 1722
Appeal No.: 2008-1072
Serial No.: 10/002,862
Filed: November 15, 2001
Confirmation No.: 4783
For: INTERMITTENT FEEDING TECHNIQUE FOR INCREASING THE MELTING
RATE OF POLYCRYSTALLINE SILICON
Examiner: Matthew J. Song

May 12, 2008

REQUEST FOR REHEARING UNDER 37 C.F.R. §41.52

This is a request for rehearing under 37 C.F.R. §41.52 from the Board of Patent Appeals and Interferences affirmation of the Examiner's rejection made in the Decision on Appeal mailed March 10, 2008.

Claims of Group I

The claims of Group I, as well as the claims of Groups II - V, all include the express requirement of "preparing a silicon melt in a crucible from which a single crystal silicon ingot is grown" involving "intermittently delivering additional unmelted polycrystalline silicon" onto a partially melted charge of silicon in a crucible. The Board asserted on pages 4-5 of the Decision on Appeal that this would have been obvious because, as acknowledged by Appellant, "a prior art device for the metered or controlled delivery of solids, such as silicon in an intermittent fashion is known (Specification, p. 14, l. 28 - p. 15, l.5)." The cited passage of Appellant's specification reads as follows:

When forming a silicon melt in an accordance with the method of the present invention, it is preferred that

the flow, or metering, of the granular polycrystalline silicon is controlled using a delivery device that comprises what is commonly referred to as an angle of repose valve. Preferably, the present invention is carried out using the device described in greater detail by Boone et al. in U.S. Pat. No. 5,059,410 which is commercially available from Crystal Growth Systems of Hanau, Germany. Among the benefits of using a device which comprise an angle of repose valve are increased purity of the grown silicon ingot and longer equipment life due to the decrease in wear from the abrasive granular polycrystalline silicon.

Rehearing is requested because the Board has misapprehended the significance of Appellant's acknowledgement and has misapprehended the reference, U.S. Pat. 5,059,410. The '410 patent discloses a valve mechanism which can be used to deliver any granular product. The device employs a non-contaminating blocking surface which holds the granular material upstream of a dispensing valve until the valve is opened. Then the blocking surface is moved to allow the granular material to free-fall through the fully opened valve. This avoids contact of the granular material with the valve. As stated in the above quote by Appellant and as emphasized in the '410 patent, purity of the granular material is maintained and wear on the valve is avoided because contact between the granular material and the valve is avoided.

This '410 patent, however, does *not* disclose intermittent feeding of silicon in preparing a silicon melt. The patent discloses a device for dispensing silicon seeds to a reactor bed where the seeds are then grown (col. 2, lns. 17-20); for, more generically, dispensing any solids from a vessel (col. 3, lns. 35-49); for, also generically, discharging solids from a vessel (col. 3, lns. 50-61); for discharging high purity silicon after

it is made by coating seeds in a reactor (col. 3, ln. 63- col. 4, ln. 10; and col. 4, lns. 11-44); and for generically discharging/dispensing high purity solid products (col. 4, ln. 45 - col. 5, ln. 25). None of these is intermittent feeding of silicon in preparing a silicon melt. Nor does this patent suggest that there is any reason to intermittently feed silicon in preparing a silicon melt. Appellant's above quote acknowledges only that he prefers to use an angle of repose valve such as the '410 device because it avoids contamination and extends equipment life.

The Decision on Appeal goes on to state that "Given the teachings of Holder and this acknowledged prior art, the record furnishes ample evidence to support the Examiner's obviousness determination as to the alternative of intermittently feeding the added granular silicon of Holder." But Holder disclosed only continuous feeding, and not intermittent feeding, in forming a silicon melt. And the "acknowledged prior art" fails to teach intermittent feeding in forming a silicon melt. So the combination of the two disclosures must also fail to teach intermittent feeding to form a silicon melt.

Moreover, even if the '410 patent could be read to disclose intermittent feeding of granular polysilicon, it is significant that it provides no reason to incorporate such feeding into a process such as Holder's to form a silicon melt. The Supreme Court's *KSR* decision, as explained in MPEP §2142, recently underscored that conclusory statements are insufficient:

The key to supporting any rejection under 35 U.S.C. 103 is the **clear articulation of the reason(s) why the claimed invention would have been obvious**. The Supreme Court in *KSR International Co. v. Teleflex Inc.*, 550 U.S. ___, ___, 82 USPQ2d 1385, 1396 (2007) noted that the analysis supporting a rejection under 35 U.S.C. 103 should be made explicit. The Federal

Circuit has stated that "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). See also *KSR*, 550 U.S. at ___, 82 USPQ2d at 1396 (quoting Federal Circuit statement with approval). (Emphasis added)

Since neither reference suggests any reason to modify the Holder process to employ intermittent feeding silicon to form a silicon melt, nor is any other reason demonstrated other than in applicant's specification, the subject matter cannot fairly be held to be obvious.

Instead of providing a reason to modify the Holder process, the Decision (p. 5) summarily notes that "there are only two options in that Holder's granulated silicon must be delivered in either a continuous or discontinuous (intermittent) fashion. Selecting the latter option would have been well within the ordinary skill of the artisan based on this record." But the fact that there are only two choices does not constitute any reason to select the latter choice. There are multiple Federal Circuit cases which hold obviousness must be evaluated per the *Graham* factors and it is error to by-pass this analysis by applying negative maxims of "invention," whether that be "synergism," "mere substitution of material," "reversal of parts," "no flash of creative genius," etc. Selecting intermittent feeding because it is the only alternative to Holder's disclosed continuous feeding is precisely such a negative maxim, directly parallel to "reversal of parts" and "mere substitution of material."

Accordingly, notwithstanding that the '410 patent discloses an angle of repose device which Appellant noted is suitable for

his intermittent feeding, and notwithstanding that there are only two choices, the case for obviousness must fail because there is no articulated reason as required by *KSR* to modify Holder's process as proposed by the Examiner and the Board.

Claims of Group IV

With respect to the claims of Group IV, they are patentable for the same reasons as the claims of Group I, and further because they require that each wedge on the exposed unmelted polysilicon does not substantially overlap the immediately preceding wedge. Rehearing is requested because the Office appears to have misapprehended the significance of this requirement of claim 52 as it relates to the proposed modification of the prior Holder process.

Assuming, *arguendo*, that one would have had a reason to feed polysilicon intermittently in forming a silicon melt, it does not follow that this express requirement of Group IV's claim 52 is achieved or even suggested. The Examiner's Answer states on page 11 that independent wedges are necessarily expected with intermittent feeding. This is by no means true, because intermittent off and on periods, in combination with the crucible rotation, would be expected to deliver polysilicon through one or multiple *complete* rotations just as readily as it would be expected to deliver polysilicon through the substantially less than one rotation necessary for the all the wedges to have substantially no overlap. In other words, one can intermittently feed 20 seconds on and 20 seconds off, and there is "substantially no overlap" as required by the claims if the rotation speed is less than a certain rotations per minute. And if one feeds for 10 seconds on and 10 seconds off, the required RPM to meet the claim requirement is yet a different number. So, as is evident from the specification and from

common sense, independent wedges are *not* necessarily expected from intermittent feeding. Rather, one must deliberately select operation parameters which yield independent wedges.

The Board perhaps recognized this shortcoming in the obviousness reasoning for Group IV, and characterized (Decision, p. 10) the expectation more loosely, as only an expectation of formation of "some type of wedge-shaped portions." But even if "some type of wedge-shaped portions" are formed by all intermittent feeding methods, the claim expressly requires that such portions be substantially non-overlapping, which is a *specific type* of wedge-shape portion suggested nowhere in the art. Nor does the art or the Office suggest any reason for forming this *specific type* of wedge shape. No such reason, prior to Appellant's specification, had ever been offered.

The claims of Group IV are therefore further patentable because intermittent feeding can leave deposits of many shapes and types, of which wedges having "substantially no overlap" are only one type. There is no suggestion in any of the references to select parameters yielding such wedges, and no reason given to modify the proposed combined process to yield such wedges.

Conclusion

In view of the above, Appellant respectfully requests withdrawal of the Board's Decision and a finding that all pending claims are patentable. Alternatively, Appellant respectfully requests withdrawal of the Board's Decision with respect to Group IV, and return of the application to the examining division for appropriate amendment of the claims.

Respectfully submitted,

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